The impact of China’s Indigenous innovation strategy on the innovation behaviour of automobile enterprises in China

POLITECNICO DI TORINO

Dipartimento di Ingegneria Gestionale e della Produzione

Doctoral Thesis

The impact of China's Indigenous innovation strategy on the innovation behaviour of automobile enterprises in China

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Abstract

China's indigenous innovation strategy is a government-led innovation strategy in the term of pushing forward the technology development both in the state-owned enterprises and in the private enterprises. It was codified in the "Medium- and Long-Term National Science and Technology development Plan (2006-2020)" which was officially announced in 2006.

There are several policy tools as the support to the indigenous innovation strategy.

- R&D funding
- Mega projects sponsored by government
- Public procurement
- Tax reduction
- Standards and patents

Automobile industry is normally regarded as the pillar of the economy as it is both labor intensive and capital intensive. It combines a lot of industries like steel industry, chemical industry, electronics industry, etc. Before 1980s, Chinese automobile industry concentrated on the commercial vehicle manufacture. Since 1980 the government started to be aware of the passenger car industry. Because of shortage of capital and technology, joint-venture was regarded as the only choice to get a rapid development for the passenger car industry at the cost of opening the market to the foreign automobile enterprises. This is a case of the famous "exchange market for technology" strategy, which is generally regarded as an aborted strategy 30 years later even though the Chinese government never officially acknowledges. In the beginning of 2000s, more than half of the Chinese passenger car market was occupied by the China-made foreign brand cars. Before the year of 2000, there are two types of automobile manufactures in China, one is state-owned enterprises, the other is the joint-ventures set up by the state-owned enterprises and their foreign partners most of which were the top automobile enterprises in the world like Volkswagen, GM, Toyota, etc. From 2000, the private capital was permitted to enter the automobile industry and became the third type of automobile enterprises in China.

Not only in automobile industry, but also in many other industries, the failure of the "exchange market for technology" happened. Even more is that the advantage of low labor cost is losing under the competition from the emerging countries like India, Vietnam, etc. The Chinese government has the willing to turn from "world factory" to an innovation-driven country for the economic development in the future. The indigenous innovation strategy is put forward to try to

solve those problems.

After the indigenous innovation strategy being push forward, the new innovation system is emerging. This thesis is to research on the change of the innovation behavior both in industry level and enterprise level under the impact of the indigenous innovation strategy.

Key words: indigenous innovation strategy, IPR strategy, patent applications, automobile industry

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1: Introduction

As After almost 30 years' high speedy development, China has become the second largest economy in the world, China is emerging to the center of the world's economic stage. This emergence has been accompanied by constant changes in its legal and economic sectors. The innovation sector also has witnessed numerous recent changes. There have been significant new advances in China's national innovation policies. 'indigenous innovation' is a national strategy put forward by the PRC government for the purpose of promoting the development of technological innovation in domestic companies, it is a policy concept that the PRC government developed to boost the creation and commercialization of proprietary ideas and technologies by Chinese companies, eventually leading to the ownership of their own core IP rights. It has been a core component of China's economic development policy for several years.

1.1 China's indigenous innovation strategy

Innovation is the process of discovering new ideas and realizing those ideas at large scale, changing the ways people live and work. In the industrial countries, innovation is regarded as the catalyst to the economic growth. Normally the innovation behavior is led by the market demand in the developed countries in which the free market plays the role of "invisible hand" which was defined by Adam Smith. In developed countries, the governments do not directly get involved in the economy activities. The enterprises fund the research in the purpose of technology development. The market competition stimulates the enterprises to produce goods with higher quality but lower price as the same as more new functions. Innovation is the only way to solve the problem. The government normally uses the tool of the public procurement to guide some research area like aerospace, military, etc. But the government does not have enough power to change the trend of the innovation of the industries.

There is no universally shared view on the proper role of government in innovation systems. In China, the government still plays an important role in directing national innovation systems. Since the Chinese economy transferred from central planning to the market economy, the government is gradually reducing the direct intervention to the economy activities, but it still play a decisive role. It is the same in the respect of the innovation. The major elements of the old national innovation system are comprised by the central government, the state-owned enterprises, Universities and government-led research institutes. A number of government agencies, notably the Ministry of Commerce, MOF, MII, MOST and NDRC, have significantly influenced science and technology and innovation policies and implementation. Other agencies also have somehow indirect influences. There are two reasons for maintaining strong government involvement in innovation. First is Chinese enterprises remain weak in developing commercially successful innovations and the Chinese government maintains the power to mobilize national resources for the development of key technologies such as high-speed railway, nuclear, aerospace, etc.

Since China's Reform and Open policy, Chinese economy got a rapid development with the advantages of low cost labor and materials. Lots of multinational companies build factories in China, so China has long been labeled with the moniker 'The World's Factory'. But at the same time, Chinese enterprises are primarily engaged in low added-value, environmentally-unfriendly manufacturing, with the more complex aspects of product research, design, and development often being dominated

by foreign entities. Under this condition, the central leadership has become increasingly aware of the necessity to transform China's economic model from a manufacturing-based to a service and IP-based one, so as to mitigate the social problems and to secure China's competitive position in international trade.

In 2004, the indigenous innovation was placed on the agenda of national policy as its importance was mentioned by the Chinese government. In October 2005, the Central Committee of the CPC passed the "Proposal for the Eleventh Five-Year Plan of National Economic and Social Development (2005–2010)," stressing that indigenous innovation will be pursued through the "formation of internationally competitive enterprises which own independent IP rights and well-known trademarks. It is developmentally risky to have foreign-owned patents underlie much of China's economic growth and to allow foreign brands to dominate the marketplace. The new 'indigenous innovation' policy was proposed under this kind of background.

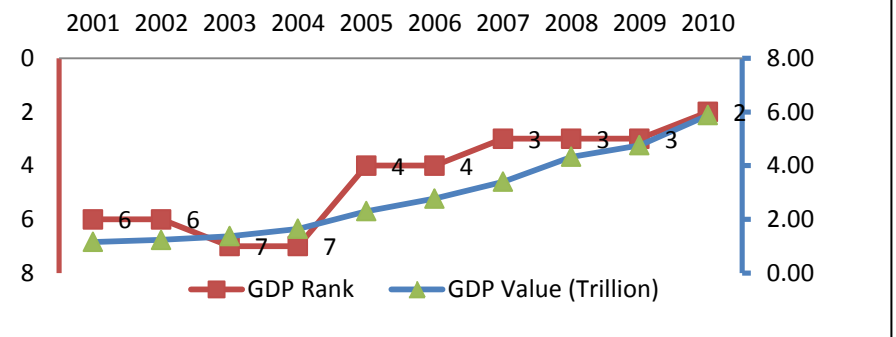


Fig. 1 – Global GDP Ranking and Annual GDP Value of China

Fig. 1 can explain what the Chinese Central-government planners were concerned about. According to the 'Global Competitiveness Report 2005-2006' which is regard as the authoritative report of global competitiveness published by World Economic Forum, the China's competitiveness rank located at the 54th position among 125 countries all over the world, which totally doesn't match the position as the fourth largest economy of the world (According to 2005 GDP Ranking of World Bank).

'Indigenous innovation' strategy is not a single policy or strategy; it is combined by a series of national policies and guidelines in the technological innovation sector. At the center of China's 'indigenous innovation' strategy is the "Medium- and Long-Term National Plan for Science and Technology Development (2006-2020)" (MLP) and a follow-up document on its supporting policies both announced by the State Council in 2006. The concept of 'indigenous innovation' was introduced into China's national industrial policy and laid out several goals— chiefly, to develop a system to evaluate and qualify 'indigenous innovation' products, establish a system to use government funds to buy such products, and give them preferential treatment in the government procurement process. The plan encouraged government agencies to work cooperatively to develop measures that would favor products that use

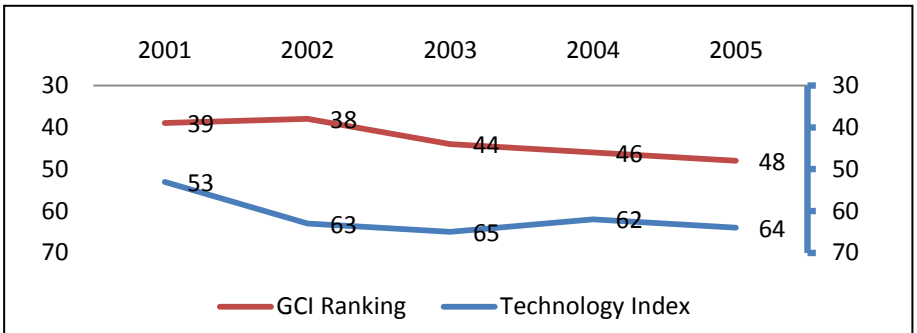


Fig. 2 –China's Global Competitiveness Index

Data from Global Competitiveness Report published by World Economic Forum

Chinese-developed ideas and technology. Since then, several central- and local-government agencies have implemented preferential policies, product catalogues, financing schemes, and other tools to ensure that the 'indigenous innovation' strategy results in the development of Chinese-owned technology and intellectual property (IP).

- The plan targets 11 key sectors for employing technology development and innovation to solve China's problems. They include energy, water and mineral resources, environment, agriculture, manufacturing, transportation, information and services, population and health, urbanization, public security and national defense. Within these sectors, there are 68 priority areas that have clearly defined missions and expectations of technology breakthroughs.
- It also earmarks eight fields of technology in which 27 breakthrough technologies are to be pursued. These include biotech, information technology, advanced materials, advanced manufacturing, advanced energy technology, marine technology, laser technology and aerospace technology.
- There are four basic research programs highlighted: protein science, nanotechnology, quantum physics and developmental and reproductive science. These research programs are aimed at exploring 18 basic scientific issues and hundreds of listed subsets ranging from the "dialogue between the human brain and computers" to "supersonic propulsion systems and super high-speed collisions" to the "evolution of black holes and diverse celestial bodies" to "biological processes within the earth's system" and "the role of the central nervous system, immune system and endocrine system in health and major disease".
- The MLP aims to solve China's energy natural resource shortage through coal liquefaction and gasification, renewable energy development, exploration and extraction technology and power grid efficiency.
- Water shortages are to be fixed through desalination and efficient distribution systems. Dozens of pollution control objectives are aimed at cleaning up China's horrific pollution through environmentally friendly fertilizers, herbicides and pesticides and waste recycling.
- Building a modern dairy industry and creating genetically modified crops are two leading aims for solving the country's food safety and limited arable land problems.
- High speed rail and electric automobile technology are priorities as are next generation internet and supercomputers, stem cell based tissue engineering, energy efficient buildings, disease prevention, manufacturing robotics, deep sea exploration expertise, fast neutron nuclear technology and drugs and reproductive health products "to ensure that the country's population is below 1.5 billion and the birth defect rate is below 3 percent".
- The goal is to increase China's gross expenditure on R&D to 2.5 percent of GDP by 2020 from 1.3 percent in 2006, with a target of basic research reaching 15 percent of R&D spending by 2020.
- The plan called for China's overall reliance on foreign technology to "decline below 30 percent" from an estimated 60 percent in 2006.
- The MLP also directed that the number of patents and leading academic papers from Chinese nationals will rank among the top five in the world by 2020.

In February 2006, the State Council issued both "The Guiding Principles of Program for Mid-to-Long Term Scientific and Technological Development (2006-2020)" and a notification about a number of accompanying policies on the implementation of the above program, requiring that 'improving 'indigenous innovation'' be made the most important aspect of all science and technology related

work and that the promotion of ‘indigenous innovation’ be carried out through tax incentives, financial support and technological investment and so on.

The MLP blueprint is full of grand visions and good intentions about international cooperation and friendship. It calls for fostering open-minded scientists who take risks and work in collaboration with the best scientists across the globe. It encourages Chinese enterprises to establish overseas research and development centers. It calls for “establishing the nation’s credibility and image in international cooperation” and “to perfect the nation’s intellectual property rights system.” It also sets goals for expanded cooperation with foreign universities, research centers and corporate R&D centers.

In September 2006 the Chinese tax bureau “Circular on Preferential Tax Policies for Innovation Enterprises” offered two year exemption of enterprise income tax.

In December, 2006 the “Administrative Measures on the Accreditation of National ‘indigenous innovation’ Products” was released collaborated by the Ministry of Science and Technology (“MOST”), the National Development and Reform Commission (“NDRC”) and the Ministry of Finance (“MOF”) , it outlined the plans for creating national ‘indigenous innovation’ product catalogues to accelerate the ‘indigenous innovation’ through government procurement. The 'Accompanying Measures' stipulate that correlating government departments must both set up systems for the authentication of new ‘indigenous innovation’ products and create a list of these products. Those products listed will be treated preferentially during government procurement. Under the 2006 Accreditation Measures, in order to qualify for an indigenous innovation product accreditation, applying enterprises must have Chinese legal person status.

In December 2006, the Ministry of Science and Technology, National Development and Reform Commission and the Ministry of Finance issued "Methods for Determining the National ‘indigenous innovation’ Products (Trial)" stipulating the norms and procedures by which ‘indigenous innovation’ products can be recognized. In order to be recognized as ‘indigenous innovation’ product, a product must fulfill the following conditions:

- The product meets the requirements set forth by China’s laws and regulations and complies with national industrial and technology policies.
- The product has been produced by an enterprise that has full ownership of IP rights in China via its own technological innovation activities; or the Chinese enterprise, work unit, or citizen has, by legal means, obtained the Chinese IP rights or usage rights.
- The product has an independent trademark, i.e., the applying entity has ownership of the registered trademark.
- The product embodies a high degree of creativity and innovation. In doing so, the product either demonstrates a mastery of core production technology; or has substantively improved upon the original product in terms of its structure, quality, material, and craftsmanship, and demonstrates a clear improvement in product performance; or has become the domestic or international technical standard in the industry.
- The product’s technology is advanced, and has reached the advanced international level among similar products.
- The product’s quality is deemed reliable through certification from the China National

Certification Administration or its provincial department branches. Products that belong to industries that have special administration requirements must have their product licenses approved and issued by the relevant departments of the State Council. Products that belong to China's compulsory product certification regime must have the certification.

- The product has already entered the stream of commerce, or has potential economic benefits and promising market prospects, or can substitute importation.

The May 2007 "Measures for Administration of Government Procurement Budgets for 'indigenous innovation' Products" suggested government at all levels to develop specific 'indigenous innovation' procurement plans or they would lose procurement funds. In the same month, "Measures for Assessment of Government Procurement of 'indigenous innovation' Products" lowered government procurement supplier qualification standards for companies doing 'indigenous innovation'.

In December 2007, the guideline of "Measures for the Administration of Government Procurement of Imported Products" which gave the guideline that the central and local government and the related agencies needed to acquire the approval to purchase imported goods was issued by MOF. A strong purpose of the guideline is to encourage the foreign suppliers with technology transfers and training services.

In January 2008 "Enterprise Income Tax Law" offered a preferential rate of 15 percent to high-tech enterprises designated by the government as 'indigenous innovation' companies because they developed and owned their intellectual property.

In November 2009, "2009 Explanatory Report Regarding the National 'indigenous innovation' Products" was drafted and issued according to the "Methods for Determining the National 'indigenous innovation' Products (Trial)" jointly by MOF, NDRC and MOST. Six high-tech industries were identified for inclusion in the 'indigenous innovation' catalogue, namely computers, telecommunication installations, modern office equipment, software, new energy, and energy saving products. In other words, only the products of above listed high-tech industries are involved in the question of the preferential treatment of the products of 'indigenous innovation' by government procurers.

In order to implement this policy, several central government agencies cooperated to develop measures that provide preferential treatment to accredited 'indigenous innovation' products in government procurement. The related PRC government agencies are responsible for developing and implementing 'indigenous innovation' policies. Here introduce the major actors of PRC government managing 'indigenous innovation'

- The State Council Leading Group on Science, Technology, and Education
- MOST – Ministry of Science and Technology
- NDRC - National Development and Reform Commission of PRC
- MOF - Ministry of Finance of PRC
- MIIT - Ministry of Industry and Information Technology of PRC

1.2 China's automobile industry

To research on the indigenous, the Chinese automobile industry is an ideal sample. The reason is the Chinese automotive industry has been the largest in the world measured by automobile unit production since 2008. Since 2009 annual production of automobiles in China exceeds that of the European Union or that of the Unites States and Japan combined. But half century before no one could draw a map like this as in 1950 there was almost no automobile industry in China. If review the he development of the China's automobile industry from 1950 to 2010, it can easily be divided by three stages.

It has been observed that the Chinese automobile industry has demonstrated a generally rising trend in the period of 1958 to present. What can be drawn out from the preceding analysis firstly is that the development of the Chinese automobile industry is different from that in other Asian countries as well as that in the West. Another distinctive picture of the Chinese automobile industry is that the Chinese government has played a dominant role in the development of the Chinese automobile industry. The Chinese government has intervened in one way or another in the development of the Chinese automobile industry. The strong government involvement in the development of the Chinese automobile industry is not a unique story. In the case of China, the nature and process of the government involvement in the development of the Chinese automobile industry has changed dramatically. While the government involvement featured direct control at the beginning stage, it then changed to guiding intervention. As seen in the previous discussion, the development of the Chinese automobile industry used to be handled by the centralized decisions of the Chinese government at the beginning stage. Then these decisions were left to automobile customers and manufacturers coordinated primarily at the market place. Although the direct control has been abandoned, the Chinese government involvement still plays a very important role in influencing the development of the Chinese automobile industry. The automobile firms would have difficulties in doing business in China without taking into account the political factors.

Here we only discuss the vehicle manufacturers excluding parts and components companies. Let's see what has happened in the past two years in China's automobile industrial. As we know now, in 2009 China took USA's place and became the biggest automobile market of the world. In 2010, China still kept this position. As a prediction, in 2011 this situation will be continued. According to the information published by Bureau of Statistics of China, from January to August, the total production amount (includes passenger car and commercial vehicle) in China is 12,3 million, at the same time the total vehicle production in USA is 5.58 million , in Japan it is 4.92 million in the same period (data from Japanese Automobile Manufacturer Association). China has already been the most productive nation of automobiles all over the world.

It can easily classify the Chinese automobile manufacturers into three types, one type is state owned automobile manufacture company, the second type is joint-venture automobile manufacture company, and the third type is local brand automobile manufacture company. The state owned automobile manufacture companies like FAW, SAIC, etc. are the main power and pillar of China's automobile industry. The joint-venture automobile companies have special position in China's automobile industry. These joint-ventures are set up by Chinese state owned automobile

manufacture companies and global leading automobile manufacture companies. They have played a very important role in the process of modernization of China's automobile industry. The foreigner partners bring advanced vehicle models; product lines and modern management into China's automobile industry, at the same time grasp huge profit from China's automobile market. These joint-ventures also enjoy the preferential tax policies and other preferential conditions supplied by Chinese government. The local brand companies survive in the gap left by the state owned companies and the joint-ventures. Most of them started from manufacturing and providing low priced cars, they grasped the opportunity of the boom of private passenger cars consumption and grew up.

To classify the China's automobile market is almost the same with to classify the Chinese automobile manufacture company. The high-end passenger car market share is occupied by imported cars from the global leading brand like Royce-Rolls, BMW, Mercedes, etc. The production of high-end market share provides high performance, luxury interior trim, high-tech electronic device and enjoyable environment. Behind all of these is the development of high-edge technology which the joint-venture automobile companies and independently owned companies can't provide. The largest part of the middle-end market share is occupied by joint-ventures. The independently owned companies take the biggest share of the low-end market. According to the market trend this structure of market share is changing slowly. The threshold of the high-end market is too high for the joint-ventures and independently owned companies to enter. But in the middle-end market and the low-end market, the joint-ventures and the independently owned companies start to compete in both two market levels. The joint-ventures create new brand to enter the low-end market in order to enlarge the market share. The independent owned companies start the brand strategy and bring different brands aim at different market segments.

The main state owned automobile manufacture companies:

SAIC Motor Corporation Limited is the biggest automobile manufacture company in China after it merged Nanjing Automotive (Group) Corporation in the year of 2007. Till end of 2009 SAIC Motor has totally 125,991 staffs (includes 34,005 from joint-ventures), of which are 16,929 technical engineers and 14,029 are R&D staffs. In the year of 2009, SAIC Motor manufactured totally 2,76 million vehicles, of which are 1,53 million passenger cars.

	2009 Gross Output Value (billion) RMB	Total Assets (billion) RMB	Total staff	Technical engineers	R&D staffs	2009 Production Volume (million)	Passenger Car Volume (million
SAIC	283,05	131,49	125,991	16,926	14,069	2,76	1,53

Table 1-The economic indicators of SAIC

Data from Chinese automobile industry yearly book

First Automobile Works has the longest history in automobile manufacture area. At the end of 2009, FAW has totally 102,947 staffs (incl. 29,064 from joint-ventures), of which there are 13,654 technical engineers and 3,967 R&D staffs. In the year of 2009 FAW totally manufactured 1.94 million vehicles, of which are 1.62 million passenger cars.

	2009 Gross Output Value (billion) RMB	Total Assets (billion) RMB	Total staff	Technical engineers	R&D staffs	2009 Production Volume (million)	Passenger Car Volume (million
FAW	300,5	131,5	102947	13654	3976	1,94	1,62

Table 2-The economic indicators of FAW

Data from Chinese automobile industry yearly book

Dongfeng Motor Corporation is currently in the top 4 along with Chang'an Motors, FAW Group, and Shanghai Automotive Industry Corporation. As well as buses, trucks, and cars sold eponymously at home and abroad, it also manufactures parts. Dongfeng is the Chinese partner in many joint ventures with foreign companies. As of 2011 it has more Sino-foreign joint-ventures than any other Chinese automobile manufacturer. In 2009, the company sold 1.9 million units, making it the second most-productive Chinese vehicle-maker. It reported 1.4 million sales of passenger vehicles that same year.

	2009 Gross Output Value (billion) RMB	Total Assets (billion) RMB	Total staff	Technical engineers	R&D staffs	2009 Production Volume (million)	Passenger Car Volume (million)
Dongfeng	265.7	242.5	143792	13418	9465	1,91	1,44

Table 3-The economic indicators of Dongfeng

Data from Chinese automobile industry yearly book

Chana automobile is an automobile manufacturer in Chongqing, China, and a state-owned enterprise with China Weaponry Equipment as parent. Its production is primarily composed of no frills passenger cars and mini-vehicles, micro vans and micro trucks that for commercial use. Also known as Chana, the company is currently one of the "top 4" Chinese automakers along with Dongfeng Motor, FAW Group, and Shanghai Automotive Industry Corporation. In 2009 it became the fourth most-productive automobile manufacturer in the Chinese automobile industry by selling 1.36 million units–a little more than 10% market share.

	2009 Gross Output Value (billion) RMB	Total Assets (billion) RMB	Total staff	Technical engineers	R&D staffs	2009 Production Volume (million)	Passenger Car Volume (million)
BAIC	109	59.4	46208	-	-	1.27	1.24

Table 4-The economic indicators of BAIC

Data from Chinese automobile industry yearly book

Beijing Automotive Industry Holding Co Ltd is a holding company of several Chinese automobile and machine manufacturers, such as Beijing Automobile Works Co Ltd, etc. Beijing Automotive Industry Holding Co Ltd (BAIC)'s state-run parents may include Beijing Automotive Group (BAIC Group), and the Beijing State-owned Assets Management Co. This can explain why BAIC companies are sometimes

referred to collectively as the Beijing Automotive Group. Commonly known by the name Beiqi or the acronym BAIC, it is thought of as the fifth-largest domestic Chinese automaker. Beiqi was one of the top ten most-productive Chinese automakers in 2009. This may be due to subsidiary Beijing Automobile Works and a sustained surge of popularity for Beijing Hyundai products. It reached fifth place by selling nearly 1.25 million units garnering a market share of more than 9%.

1.2.1 The establishing of China's automobile industry

The first stage was from 1950 to 1980. In this stage, a significant feature was the automobile industry focused on the commercial vehicle as the country needed rapidly developed the industry. The initiation of the establishment of the Chinese automobile industry dates back to March 1950, when the national meeting was held in order to set up the automobile industry in China. During the primitive period, the youthful Chinese automobile industry was beset with technical and economic difficulties. The qualified technicians and well-trained working forces, for instance, were scarce at the time. Infrastructure barriers, too, exerted a retarding influence on the early development of the Chinese automobile industry. Another barrier to the early development of the Chinese automobile industry was the insufficiency of capital. In such a situation in which the Chinese automobile industry could hardly find a way of self-development, foreign aid from the Soviet Union played an important role in establishing the automobile industry in China. The Soviet Union also helped China established a number of large-scale modern firms and trained plenty of young technicians.

Besides the foreign aid underlying the huge economic supports of the Soviet Union, the Chinese government launched a nation-wide campaign to encourage the early development of the automobile industry. The Chinese government also undertook a series of measures to encourage the early development of the automobile industry as a part of its First Five-Year Plan from 1953 to 1957. More important is that Chinese automobile workers devoted all their efforts to their tasks in establishing the automobile industry. They endured low wages, hardworking surroundings, and so forth. This fact indicates a clue to explain why the Chinese automobile industry was brought into being rapidly. For China during the 1950s, the dominant characteristics of the formation of the Chinese automobile industry were direct government investment and control. More specifically, the Chinese government invested RMB Yuan 6,600 million in establishing the automobile industry during this period. In 1953, China started to build its first modern automobile factory -- The First Automotive Works (FAW) in Changchun City, Jilin Province. Three years later, the construction of FAW was completed. The FAW was established with a planned productivity of 300,000 vehicles. On July 13th, 1954, the FAW manufactured the first 4-ton truck in China – Jiefang Truck which was based on the type of GAZ 57 (a product of GAZ automobile factory which was the state-owned automobile manufacturer of the Soviet Union in 1950s).

From 1950 to 1977, as for the formation of the Chinese automobile industry at this stage, the whole series of events was not possible without the state's direct control from the utilization of the economic aid of the Soviet Union, to the nation-wide campaign to encourage the development of the automobile industry. The Chinese automobile industry was confined almost exclusively to internal development at the time. China's isolated position at the time made the circumstances surrounding the development of the automobile industry even worse. In contrast, the manufacture of automobile

flourished in other Asian countries at the same time. Besides the South Korean automobile industry, the Japanese automobile manufacturing profited not only by the early shift to the economical car production but also by the well-trained employees, the continuous technical innovation, and the global vision. In 1965, cars occupied only 37.1% of the total motor-vehicle output in Japan while trucks occupied 61.9%. Ten years later, cars occupied 65.8% of the total motor-vehicle output in Japan while trucks declined to 33.7%.

1.2.2 The growth of China's automobile industry from 1978 to 2000

Beside the macroeconomic adjustment and control conducted by Chinese government at the beginning of 1990s, China's automobile industry has been keeping a continuing growth in the stage of past 30 years. Now the year 1978 is regarded as the beginning of a new stage, because in this year the Chinese government officially announced the Reform and Opening policy and made it as a basic national policy for at least 50 years. This policy brought a fresh air to the China's rigid economic. The Reform & Open policy left tremendous consequences on the Chinese society from economy to ideology.

To the China's automobile industry, the Reform and Opening policy brought not only a big chance, but also a big challenge which maybe the biggest one China's automobile industrial had ever met. In this condition, China's automobile market would start to open to the whole world, the global leading automobile manufacturers were coming and would bring advanced technology and management into China, and how to prevent China's national automobile industrial from being destroyed was a big question in front of China's automobile industry. At that moment China's automobile industry in particular for passenger car manufacture was still in the way of half-handmade even though the automatic assembly line already had been created by Henry Ford sixty years ago.

In the year before 1980, for ordinary Chinese people a private passenger car is like Arabian nights. On one side Chinese government did not encourage private car consumption, on the other side even someone had enough money to afford a car, there was nowhere for him to buy a car, because all the production was produced and delivered according to a so called plan. Under the framework of planned economy China's automobile manufacturers only needed to product according to the plan which was made last year or even more years ago, as the supply chain was also planned in the same way. So the China's automobile manufacturers did not need to consider the customers and suppliers. Everything was planned, although this kind of plan was always disturbed by reasons.

In the years after 1981, since China's Reform and Open policy had started to execute, along with the introduction of market mechanism into the Chinese economy, China's automobile industry started to change and develop because there would no longer be a plan. China's automobile manufacturers realized that if they were to survive in a market-oriented economy they would have to develop new technology and product well-designed products for the new coming private firms and individuals. The Chinese government decided to reform the automobile industry; as a result, China Automotive Industry Company was established in May 1982. China Automotive Industry Company had 7 subsidiaries included six automobile manufacturers and one components and parts manufacturer.

These changes were the signal that the Chinese government began to change the form of central control to local decision in order to stimulate China's automobile industry and encourage the local area automobile manufacture and consumption in China. As the response to the change, lots of automobile companies were set up consequently. The Chinese government started to treat the automobile industry as a crucial industry to stimulate the development.

At that moment, all of the automobile manufacturers were state owned. After the gate of China re-opened to the whole world, it was easily to find out the discouraged fact that China's automobile industry had at least 20 years' lag both in technology and in management compared with western countries. To catch up seemed an impossible mission because of several reasons. The first one is as the automobile industry was a capital-intensive industry; the Chinese economic foundation was too weak to support such huge investment. The second one is that the technological lag was so huge to step over. So the Chinese government decided to find some kind of external power to solve these problems. After several times' contacted with the international leading automobile companies, the Chinese government accepted the principle of joint-venture.

In the year of 1983, Beijing Automobile Works (BAW) and the USA automobile manufacturer AMC (acquired by Chrysler in 1987) signed on the "Operation agreement" and "Joint-venture contract", the first automobile joint-venture of China was set up in Beijing, the capital of China. According to this contract BAW held 68.65% share of the joint-venture, AMC held 31.35% (After 1987 is Chrysler). The main production of the joint-venture was off-road car-the Jeep serial. In October of 1984, a symbolic event of China's automobile industry happened in Shanghai, Germen automobile manufacturer Volkswagen and Shanghai Automobile Industry Corporation (SAIC) signed the contract to establish the first passenger car joint-venture-Shanghai Volkswagen (SVW). This event now is regarded as the start of China's automobile industry modernization. In SVW, SAIC held 50% share, Volkswagen Group held 40% and Volkswagen (China) Investment Corporation held 10%. That means in SVW, Chinese partner and Germen partner each own 50% of shareholding. This kind of shareholding ratio almost became a fixed model to the joint-ventures till now. In the following years, Chinese government officially issued several guidelines on joint-venture automobile companies; a very important one is in the joint-venture the shareholding ratio of Chinese partner could not lower than 50%.

During this stage, China's automobile industry got a rapid growth. There were two reasons to explain the great leap forward. First is the market need of the automobile products was stimulated by the development of China's economy as the result of the "Open and Reform" policy

1.2.3 The rapid development of China's automobile industry in the first decade of 21st century

The year of 2000 was regarded as the beginning of 21st century, in October of this year the tenth Five-year Plan was discussed and passed. The most important clause listed in the plan for China's automobile industry was that the Chinese government encouraged private car consumption. Also in the same year, the president of Germany said in an interview that every germen family should have at least one car; it sounded like a dream far way for Chinese people to image a car for each family at that moment. But nobody even included the professional consulting companies and institutes like McKinsey could have predicted that ten years later the dream is coming true.

The year of 2001 was the most important year since the Reform and Open policy was announced. China became the member of World Trade Organization so called WTO. It was also so important to China's automobile industry, China's becoming the member of WTO brought a huge chance and also risks to China's automobile industry. The huge chance was that China's automobile industry had the chance to take part in the global market; more and more giant automobile manufacturers would come and bring the new technology and industrial management to China. The risk meant China's automobile industry would have the danger to lose its independent position. Even more was that according to the agreement signed by China and WTO the tariff of vehicle production would be reduced from 80% in 2001 to 25% in 2006. As the price of imported vehicle would be cut down, the price and profit space for China's independent brands would be compressed year by year. But for Chinese customers the reduction of vehicle import tariff was absolutely good news, the sale market started to accelerate from then on.

In the year of 2002, the output of China's automobile industry reached 3 million, and also the vehicle sale volume reached 3 million which seemed to be a response to the reduction of vehicle import tariff. In the same year State Development and Reform Commission of China began to draw up the new China's automobile industry policy as the old one which was published in 1994 could not suit the development of China's automobile industry.

After 2 years discussion and preparation, on 1st of June, 2004 State Development and Reform Commission of China published the new policies of China's automobile industry. Compared to the old version published 10 year ago, the New Policy includes both more restrictive and more liberal clauses. Some of important differences of the new version were:

The Policies called for a reform of the Chinese automobile industry by the year 2010 in order to create large companies that can compete on the international market. As part of this reform, car and motorcycle manufacturing enterprises were encouraged to develop international cooperation and large enterprise groups were encouraged to associate or merge with international automobile groups.

- The new Policies encouraged the innovation of China's automobile industry.
- The new Policies encouraged the automobile manufactures to develop production with independent intellectual property rights.
- The new Policies required domestic and foreign automobile manufactures to establish a car brand sales and service system as soon as possible. This system could be set up by the manufacturer directly or by car distributors appointed by it.
- The new Policies encouraged the automobile manufacturers to develop cleaner technologies and new fuel car in order to reduce the vehicle emission.
- The Policies also addressed various issues aimed at developing a consumer-led automotive market that includes (new and used) car retailing, servicing, financing and related activities.

1.2.4 Statistic view of China's automobile industry

Of the automobiles produced, 44.3% were local brands (including BYD, Lifan, Chang'an (Chana), Geely, Chery, Hafei, Jianghuai (JAC), Great Wall and Roewe), and the rest were produced by joint ventures with foreign car makers such as Volkswagen, General Motors, Hyundai, Nissan, Honda, Toyota, Mitsubishi etc. While most of the cars manufactured in China are sold within China, exports reached 814,300 units in 2011. China's home market provides its automakers a solid base and Chinese economic planners hope to build globally-competitive auto companies.

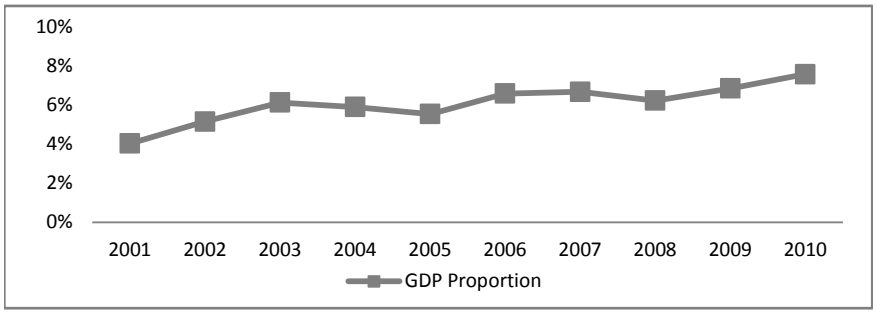


Fig. 3- Gross Output Value of China's automotive industry in GDP Proportion

Data from Chinese automobile industry yearly book

The chart shows the vehicle production volume of China's automobile industry from 2000 to 2010. In these ten years, the vehicle production volume increased rapidly at a sharp rate from 2 million in the year of 2000 to 18.3 million in the year of 2010, more than six times. The boom of the passenger cars consumption devoted a large part of the increase. Benefit from the increase of Chinese consumers' incoming, the passenger car production got a rapid increase from 2000 to 2010, the passenger car production volume of 2010 was almost thirteen times of that in 2000. Because of the development of China's economic and Chinese government's keeping investing on the infrastructure, the production of the commercial vehicle and buses also increased quickly from 2000 to 2010.

Except the year of 2005, the vehicle import volume of China from 2000 to 2009 increased quickly. In 2000, this number was 42.7 thousand units, but in the year of 2009, the vehicle import volume climbed to 813.4 thousand units, almost twenty time of the number in 2000.

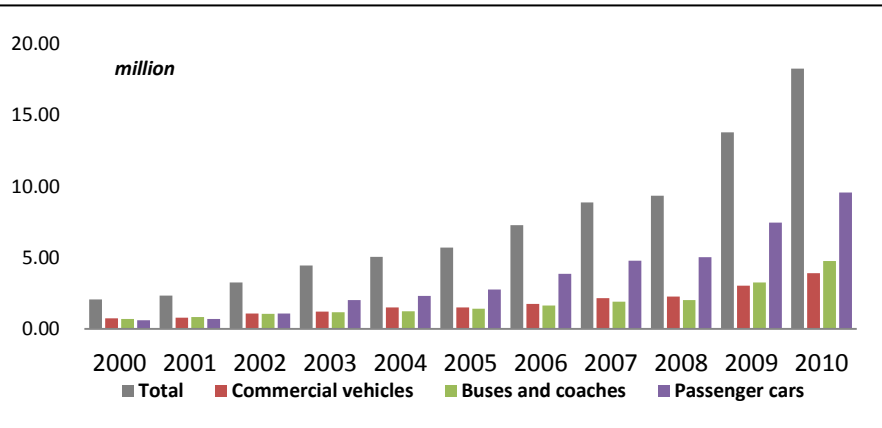


Fig. 4 –Vehicle production of China from 2000 to 2010

Data from Chinese automobile industry yearly book

In 2009, there were totally 420.7 thousand vehicle were imported to China, of which were 49.29% of SUV, 39.18 of sedans and 8.48% of MPVs, the trucks and buses take a very small share as showed in Fig. 4.

The Fig.5 shows from 2000 to 2002, the vehicle export kept an inactive situation. From 2003 to 2008, with the increase of the vehicles produced by the independently owned automobile manufacturers, the vehicle export volume got a rapid raise. In the year of 2009, under the impact of the global financial crisis, the vehicle export volume declined almost 50% compared to the year of 2008. In the year of 2010, with the recovery of the economies from the financial crisis, Chinese vehicle export acquired a 53% raise compared to the year of 2009, but the total vehicle export volume of 566.7 thousand vehicles was still less than 2008 of 681 thousand vehicles.

As the competition intensifies in China's automobile market, more domestic manufacturers have shifted their focus to foreign countries. To gain more access to the overseas market, China's auto makers have begun to launch factories abroad. As showed in table 2.6, the most vehicle export destinations still concentrate to Africa and middle-east countries except Germany. It will still be a long time in the future for the Chinese automobile manufacturers to export vehicle to U.S. and Europe.

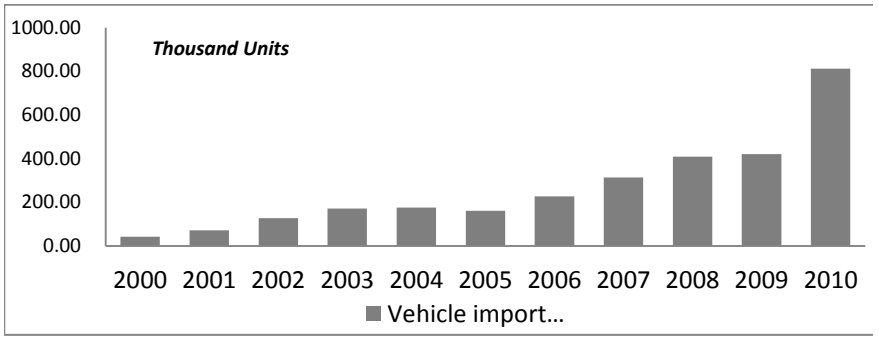


Fig. 5 –Vehicle import volume from 2000 to 2010

Data from Chinese automobile industry yearly book

In 2011, the total vehicle production volume of China's automotive industry reaches 184.1 million, still keeps the first position of the rank of global vehicle production and takes 23 percent share of global vehicle production. But compared to the year of 2010, there is only a 0.84 percent increase; the growth rate is the lowest in the past thirteen years. Of these, the production volume of passenger vehicles is 14.5 million, a 4.23 percent increase compared to last year; the production volume of commercial vehicles is 3.9 million, a 9.94 percent decline compared to the year of 2010. The main reasons why the growth rate of the production volume in 2011 got a remarkable decline is the cancellation of the Vehicle Purchase Tax Subsidy from 1st, Jan, 2011, which was as part of the China Autos Stimulus Package originally announced in Jan. 2009 by the State Council.

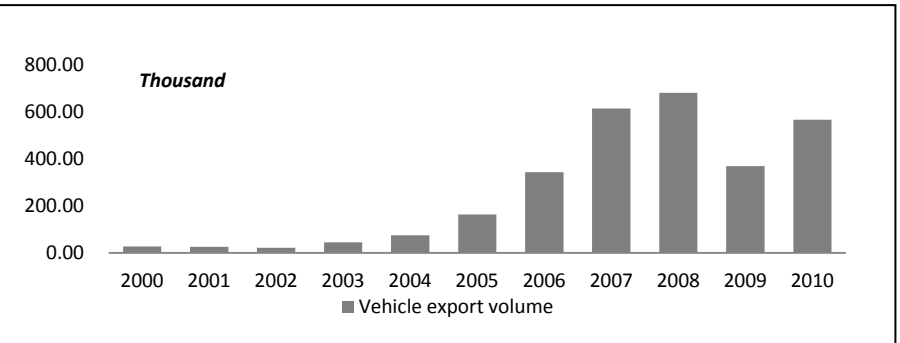


Fig. 6 –Vehicle export volume from 2000 to 2010

Data from Chinese automobile industry yearly book

2: Literature review

China's Indigenous innovation strategy causes extensive attention from domestic and abroad, especially in USA, Germany and Japan. A lot of papers or articles were published in analyzing the motivation for Chinese government to put forward the indigenous innovation strategy.

In 'China: Intellectual Property Infringement, Indigenous Innovation Policies, and Frameworks for Measuring the Effects on the U.S. Economy' published by U.S. International Trade Commission discussed the link between the indigenous innovation strategy and the intellectual property infringement, and the impact of the indigenous innovation strategy on the economy of USA.

McGregor (2010) conducted a study of China's indigenous innovation strategy in which the indigenous innovation strategy was described as a web of policies in which the foreign companies are trapped. The study came out the pessimistic result that the technology advantage of the foreign companies will be weaken under the impact of the indigenous innovation strategy. In the study the indigenous innovation strategy is regarded as the second act of 'Open and Reform' policy which shows the ambition of Chinese government to change the reputation of made in China to innovated in China. On one side it pointed out the awkward situation the foreign companies faced that the foreign companies don't want to give up their dominant position of advanced technology innovation in the mean while they also can't ignore the potential of Chinese market. On the other side it worried about China's lax enforcement of IPR protection.

Most of the researches discussed on the macro economy level, at most reached the industry level without paying much attention on the firms. For the automobile industry of China, there isn't any research of the innovation strategy under the impact of the indigenous innovation strategy particularly. This thesis

3: The new innovation system of China is emerging under the impact of the indigenous innovation strategy

In 2006, the State Council of China announced "Medium- and Long-Term National Plan for Science and Technology Development (2006-20)" (MLP) and a follow-up document on its supporting policies. The indigenous innovation strategy is a combination of a series of policies and guidelines.

	2001	2002	2003	2004	2005	2006	2007	2008
National R&D Funding (Billions,USD)	12.6	15.56	18.6	23.7	30.1	38.5	50.8	66.2
R&D funding/GDP	0.95%	1.07%	1.13%	1.23%	1.34%	1.42%	1.52%	1.70%
Annual growth ratio to last year	23.5%	19.5%	27.4%	27.0%	27.9%	31.9%	30.3%	30.8%

Table 5 – National R&D Funding, 2001-2008.

The implement of the indigenous innovation strategy can be roughly regarded as series of policy tools. These policies were launched by several departments/bureaus of the central government like Ministry of Science and Technology of the People's Republic of China (MOST), National Development and Reform Commission of the People's Republic of China (NDRC) and Ministry of Finance of People's Republic of China (MOF), etc.

The direct tool is the R&D funding by which China expects to upgrade its innovation capability. The way to fund the R&D is to provide research projects. MOST is in charge of the projects management. It chooses the topic in related area like industry, transportation, medical, agriculture, aviation, etc. All the Chinese domestic enterprises in related area have the qualification to apply for the projects. Their application will be examined by MOST in order to identify if the technology capability of the enterprise can satisfy the requirement of the project. But an indisputable fact is that the state-owned enterprises are easier to pass the examination.

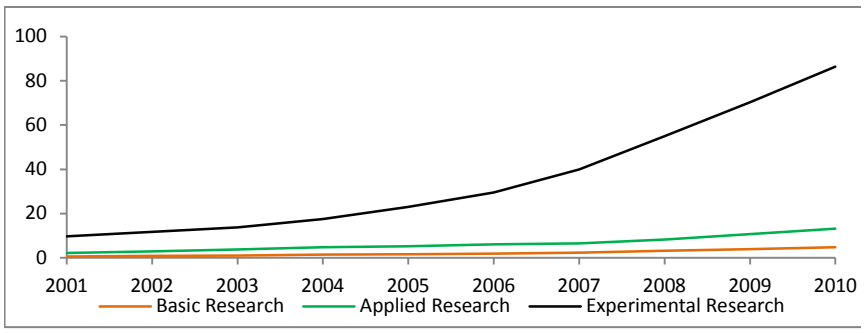


Fig. 7 – Annual Funding of Basic and Applied Research and Experimental Development of

Table 5 demonstrates that the central government is increasing funding for R&D, significantly after 2005. Beside the projects, MOST also has a series of long-term R&D programs. Each of these programs has a major topic which focuses on some certain research area.

	2001	2002	2003	2004	2005	2006	2007	2008
"973" Basic Research	71.2	82.8	96.6	108.3	121.8	173.6	225.5	275.4
Key technologies R&D program	127.2	161.6	162.5	195.0	201.3	384.6	745.4	734.8
"863" High-tec program	301.9	305.9	1147.8	1122.3	1409.6	-	-	-
National key laboratories program	15.7	15.7	15.7	1.6	16.6	27.7	21.9	23.3
Innovation fund for SMEs	94.6	65.2	99.9	99.9	122.5	108.1	172.1	211.6

Table 6 – National Science and Technology Program Funding, 2001-2008.

Fig 7 shows that China focus funding on more experimental development than on applied research and basic research. China still under invests in basic research, despite more than six years of implementing its national indigenous innovation strategy. A nation's basic research relies heavily on government research and development funding.

Table 6 gives an overview of the major program led by MOST. Among these science-and-technology programs the national high-tech program (short for "863" program) which was launched in March, 1986, has been the priority. It is focusing on the specific goal of bringing Chinese

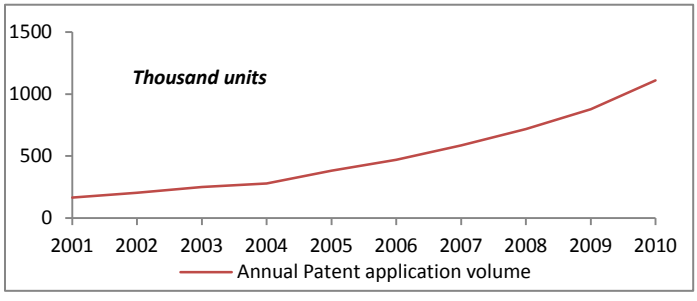


Fig. 8 Total patent applications of China 2002-2009.

high technology up to contemporary global standards.

After a series of the policy tools used, the new innovation system is emerging. The patent application is commonly regarded as an indicator to measure the innovation performance. Fig.8 shows the growth of the volume of the patent applications in China from 2002 to 2009. After the year of 2005, it appears a significant acceleration as the response to the Chinese indigenous innovation strategy.

4: The response of the automobile industry to the indigenous innovation strategy

In the automobile industry, according to the capital property the automobile enterprises can be divided into three types. The SOEs are the state-owned automobile enterprises. The non-SOEs means the automobile enterprises are funded by Chinese domestic capital which is not owned by the state. The foreign-funded enterprises means the automobile enterprises are funded by foreign capitals including joint-ventures (including the capital from Hong Kong, Taiwan, Macau). The vehicle productions produced and sold in China under the foreign brand are normally regarded to devote to the output value of the foreign-funded enterprises.

As showed in Fig. 9, since 2003 the total output value of three type's enterprises of automobile industry got a significant increase benefited from the strong market demand. However each ownership type has progressed different rate. Not only are non-SOEs clearly progressing at the highest rate, they also boast a 2007 total industrial output value of US$69.6 billion. Foreign-invested enterprises produced a total of US$68.9 billion in 2007. In 2007 state-owned enterprises fell to third place with a total output value of US$38.2 billion.

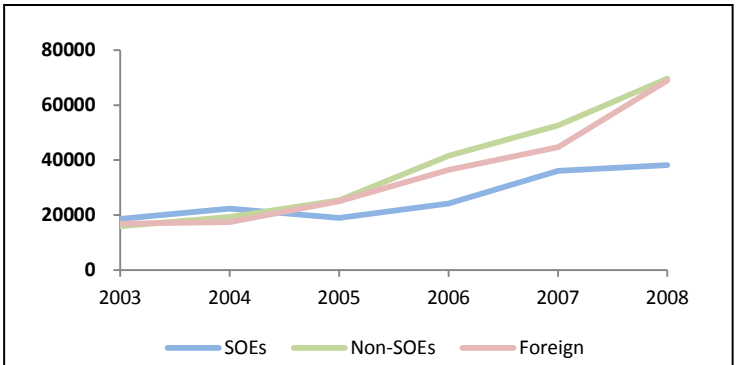


Fig. 9 – Total output value of China's automobile industry (Millions USD).

For the innovation system of the enterprises, the R&D employees are the main innovating actors. To keep such employees, enterprises must both pay them well and provide them with high-quality research and development infrastructures. Whether or not an enterprise is innovative largely depends on the number and the quality of the inventors employed. In China usually only large SOEs have historically been able to maintain a large number of scientists and engineers as employees. However Figure 10 indicates a clear trend: between 2002 and 2007 the absolute number of scientists and engineers working in SOEs declined.

The scientists and engineers working in SOEs declined significantly from 13.2 thousand in 2003 to 12.7 thousand in 2008. The number of scientists and engineers which are hired by non-SOEs and foreign-funded enterprises increased between 2003 and 2008.

While SOEs have continued to receive strong support from the central government their human resources devoted to research and development appear to have been declining since before 2005. In the mean while non-SOEs and foreign-funded enterprises have steadily increased their research and development employees. This trend indicates that a redistribution of innovation resources is beginning to emerge in China and that the earlier pre-2006 innovation policy so favorable for SOEs is no longer significantly detrimental to the innovation efforts of non-SOEs.

Patent application volume is a significant indicator of the innovation performance. Fig.10 shows the patent application volume of the top four automobile enterprises (according to the vehicle production volume) of each type of SOEs, Non SOEs and Joint-ventures. It shows clearly that from 2003 to 2005, the patent application volume increased very slowly. After 2005, the patent application volume of each type got a rapid raise. The patent applications of non-SOEs increased significantly faster than the other two types of automobile enterprises. Of the three types, the patent applications of the SOEs increased most slowly.

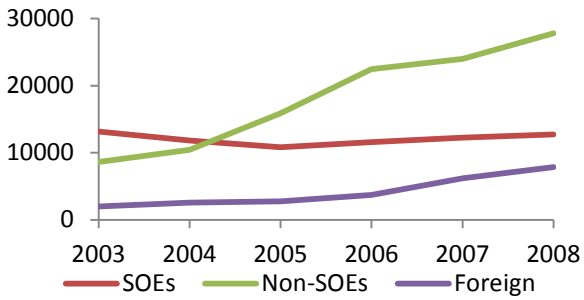
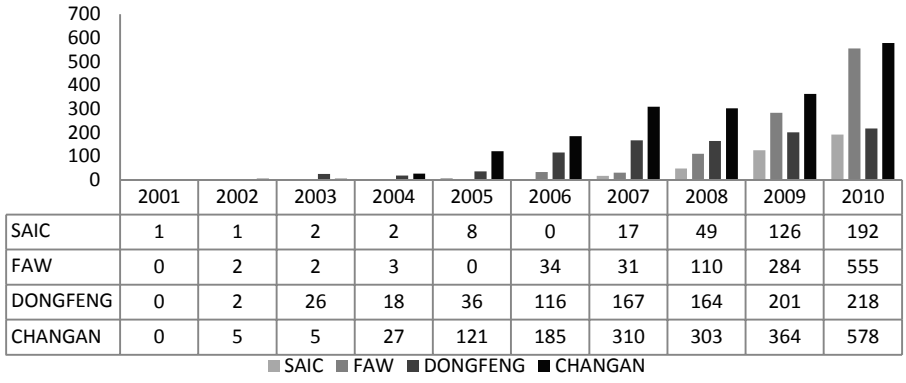


Fig. 10 – Number of R&D employees, 2003-2008

5: The response of the automobile enterprises to the indigenous innovation strategy

The state owned automobile enterprises are placed high hopes to take the responsibility of technology innovation in China's automobile industry which was considered as the main purpose of the 'exchange market for technology' policy. After almost two decades from 1980 to 2000, the policy can hardly be regarded as successful for the technology innovation of the Chinese automobile industry. The result of the implementation of the 'exchange market for technology' policy can be divided into two parts – the successful part and the failed part which means the result didn't match the original purpose of the policy, the success part of the policy was the foreign automobile enterprises acquired the market via sale the cars under the foreign car brands that the cars were manufacture in China and import from abroad; the foreign automobile enterprises built the whole supply chain in China and introduced the modern management system to the Chinese automobile industry, the failed part was for the state-owned automobile enterprises that the innovation ability didn't developed well as it was designed by the policy. The technology innovation of the state-owned companies still depends on their foreign partners. From 2001 to 2005, the patent applications of the state-owned automobile enterprises are less than 100 pieces per year which doesn't match the leading position in the Chinese automobile industry.

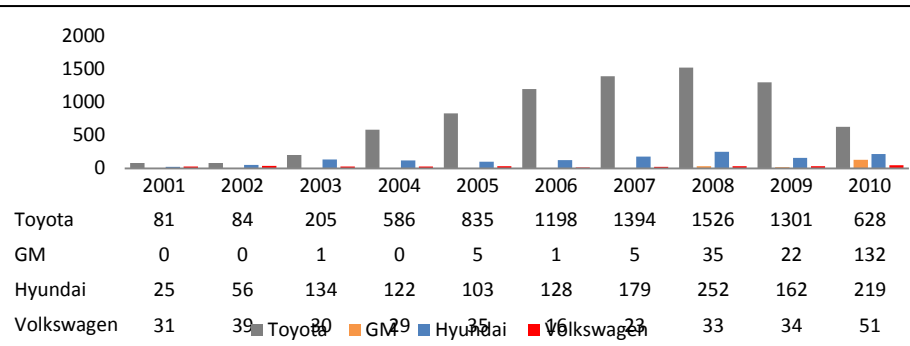
From 2006, under the force of the implementation of a series of the indigenous innovation policies by the Chinese government that the self-owned IPR was considered as one of the main indicators of the indigenous innovation, the state-owned companies started to turn from depending on foreign partners to indigenous innovation. The IPR strategy was also paid more attention. It shows that from 2006, the volume of patent application of the four state-owned companies which are chosen as the samples got the obvious raise.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SAIC	1	1	2	2	8	0	17	49	126	192
FAW	0	2	2	3	0	34	31	110	284	555
DONGFENG	0	2	26	18	36	116	167	164	201	218
CHANGAN	0	5	5	27	121	185	310	303	364	578

Fig. 11 –The yearly patent application volumes of SOEs

After 2006, the four state-owned automobile enterprises all began to build self-own brands and to develop self-innovation strategy. SAIC acquired the IPR of Rover's 75, 45 and 25 car types in 2006 and developed its own-brands 'Roewe' and car type Roewe 750, 550, 350 based on Rover's car types. In the same year of 2006, FAW announced its self-own car brand – 'Besturn'. The first car type of Besturn was based on Mazda 6 that FAW was permitted to utilize all the IPR. In 2007 Changan set up its oversea R&D centers in Turin, Italy and Yokohama, Japan, etc. In the respect of the patent application volume, the state-owned automobile enterprises don't perform as well as its increase of production volume.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Toyota	81	84	205	586	835	1198	1394	1526	1301	628
GM	0	0	1	0	5	1	5	35	22	132
Hyundai	25	56	134	122	103	128	179	252	162	219
Volkswagen	31	39	30	29	35	16	23	33	34	51

Fig. 12 –Yearly patent application volumes of the foreign automobile enterprises

For the foreign automobile enterprises, all the patent applications filed in SIPO have the priority in other patent office like USPO, JPO and EPO. To apply the patent in China is in the purpose of achieving the IPR protection in China. The IPR strategy of the foreign companies in China can be regarded as a part of their global IPR strategy. In the whole period from 2001 to 2006, the yearly patent application of foreign automobile enterprises kept stable in general.

From 2006 to 2008, it appears a tardo raise of the patent application. A curve appears in 2008, under the impact of the global financial crisis, the patent application declined.

In the respect of the patent application volume, Toyota is the activist as its performance in world wide. It can be concluded that the indigenous innovation strategy almost has no obvious impact on the IPR strategy of the foreign automobile enterprises.

The automobile joint-ventures have the special position in China's automobile industry as they were set up together by the state-owned companies and the foreign companies. On one side, the automobile joint-ventures enjoy the policy support from the state-owned companies which are directly supported by the Chinese government. On the other side, the joint-ventures obtain the capital and technology support from the foreign automobile enterprises. As the joint-ventures manufacture and sale the car products under the brands of the foreign companies, the technology innovation of the joint-ventures normally is dominated by the foreign companies which is the common cooperate mode in the joint0ventures. A obvious result of the cooperate mode is that the IPR strategy of the joint-ventures in China is the least active.

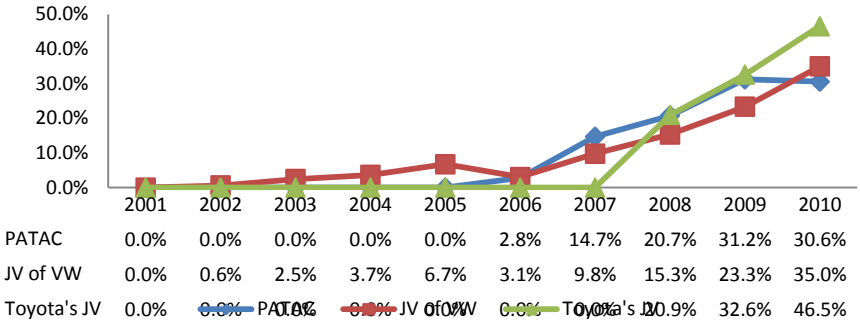


Fig. 13 –Yearly patent application volumes of the joint-ventures

As is showed in the chart above, from 2001 to 2006, the joint-ventures almost had no patent applications in China. There is a big change from the year of 2006. After the indigenous innovation strategy was announced around 2006, the innovation strategy of the joint-ventures started to turn to local innovation that means the joint-ventures gradually put more innovating power in China to realize the domestic innovation strategy in order to , on one side follow the indigenous innovation strategy policy; on the other side, reduce the cost of innovation. A noticeable issue is the high-edge technology innovation like powertrain and transmission is still kept in the home countries of the foreign automobile enterprises. The technology innovation in China mainly focuses on the re-engineering, adjusting and non-core techniques.

In general the patent application volume of the joint ventures is the least in comparison with the state-owned companies and the non-state-owned companies. The highlight is PATAC. PATAC is the automobile technology companies set up by GM and SAIC in Shanghai in 1997. It is a design and engineering center and is involved in engineering for GM products, including the GM Theta platform and Saturn Vue. By 2011, it has over 2000 salary employees. Originally PATAC is set up as the engineering and design department of Shanghai-GM in charge of reengineering the involved GM car

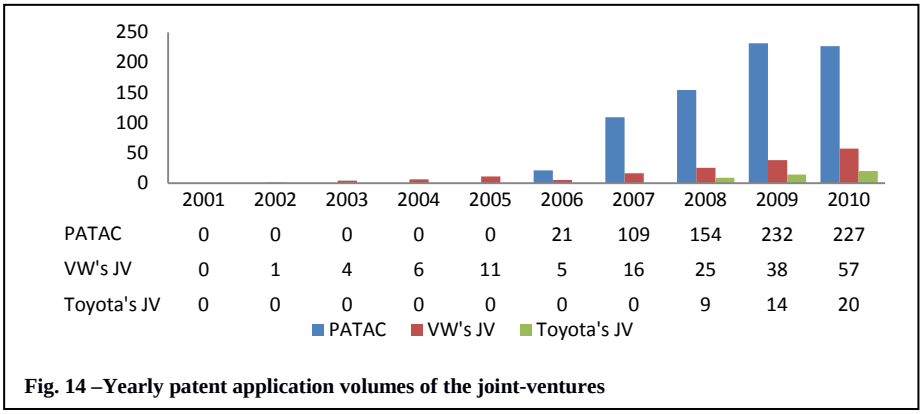
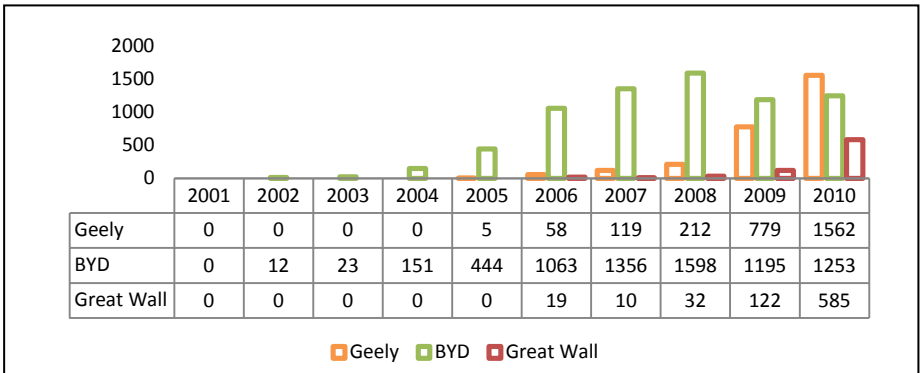


Fig. 14 –Yearly patent application volumes of the joint-ventures

type in order to fit the Chinese automobile market. With the development of PATAC, it became an independent limited company and started to plan its innovation strategy. From 2006, its technology accumulation gave it a rich payback in the respect of IPR.

The non-state-owned automobile enterprises can be regarded as the most active in the respect of technology innovation as they are the weakest power in comparison with the state-owned companies and the joint-ventures in the Chinese automobile industry. The non-state-owned automobile enterprises can neither obtain the support direct from Chinese government as much as the state-owned automobile enterprises, nor the non-state-owned companies have enough capital and technology compared with the automobile joint-ventures. Most of the non-state-owned automobile enterprises started their car business around the year of 2000 when the policy limitation of private capital in automobile industry was removed.

For the non-state-owned automobile enterprises, the technology innovation is most important to stand in the market competing with the state owned companies and their joint-ventures. The period from 2001 to 2005 can be regarded as the period of technology accumulation for the non-state-owned automobile enterprises. The process of the innovation strategy of the non-state-owned companies in general can be concluded as 'imitation – reengineering – innovation' which is similar to the development process of Japanese automobile industry in the 1970s. Normally the non-state-owned companies started with imitating some mature car types in order to reduce the development cost and time. From the process of the reengineering the non-state-owned companies obtain the accumulation of the technology. Innovation can be regarded as the result of the technology accumulation. For the non-state-owned companies, to get the whole IPR there are several ways, the first is self-innovation which is slow but solid, the second way is consigned R&D and the third is cooperation with universities or research institutes domestic or abroad. From 2006, it shows an obvious raise of the patent applications of the non-state-owned companies. It can be concluded as the innovation strategy of the non-state-owned companies already changed from 'learn from others' to 'innovate by self'.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Geely	0	0	0	0	5	58	119	212	779	1562
BYD	0	12	23	151	444	1063	1356	1598	1195	1253
Great Wall	0	0	0	0	0	19	10	32	122	585

Fig. 15 –Yearly patent application volumes of thee non-state-owned enterprises

In comparison with the state-owned automobile enterprises and the joint-ventures, the non-state-owned companies were the smallest in scale and power, but the most patent applications. Especially after the indigenous innovation strategy was implemented, the IPR strategy of the non-state-owned companies changed from active to aggressive.

6: Case study of BYD

BYD is a Chinese manufacturer of automobiles and rechargeable batteries based in Shenzhen, Guangdong province of China. Hailed for its innovations, BYD has grown to become a major manufacturer of rechargeable batteries, most notably mobile phone batteries. BYD topped the 2010 Bloomberg Business week Tech 100 list, a list of large, fast-growing tech companies.

BYD started its business with the rechargeable batteries in 1995 and tapped into the automobile industry in 2002 by the acquisition of Tsingchuan Automobile Co., Ltd which was renamed as BYD Automobile Co., Ltd in 2003. After BYD entered in the automobile industry, BYD formed its special innovation strategy. Especially as BYD has the IT business and the rechargeable battery business, BYD has the natural advantage in the development of New Energy Vehicle (NEV) industry as showed in the chart below.

BYD''s innovation system can be divided to three levels. These three levels of R&D departments constitute BYD's innovation network. If described to the human body, the three levels can be apart described to the brain, the torso and the limbs.

The Central Research Institute is the planner of BYD's innovation strategy in middle – long term. It is in charge of developing technical reserves for the future development. The main responsibility of the Central Research Institute was listed below.

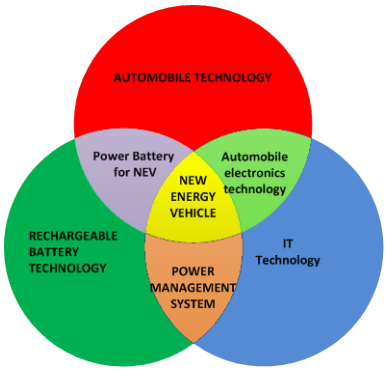


Fig. 16 –BYD's vertical integration strategy

- Foundation theory research in the relevant areas like automobile, IT and battery
- Collect, analyzing, research and absorb the patent information in relevant areas
- Cross-sectorial integration
- Supply theoretical support to the second level

The second level is made up by fifteen R&D institutes in respective area corresponding to different manufacturing departments. These R&D institutes are divided to two segments – the automobile segments and the battery segments. The main function of the battery R&D department is in charge of the applied research in the direction planned by the central research institute. The automobile R&D department in Shanghai is in charge of the automobile engineering development and test.

Beside the three-level R&D structure, a very important department is the patenting affair department. The patenting affair department isn't a law-related department but a patent information support center which provides the patent information to the R&D department to evade the patent barriers. In the meanwhile, it is in charge of patenting affaires to manage BYD's patent portfolios.

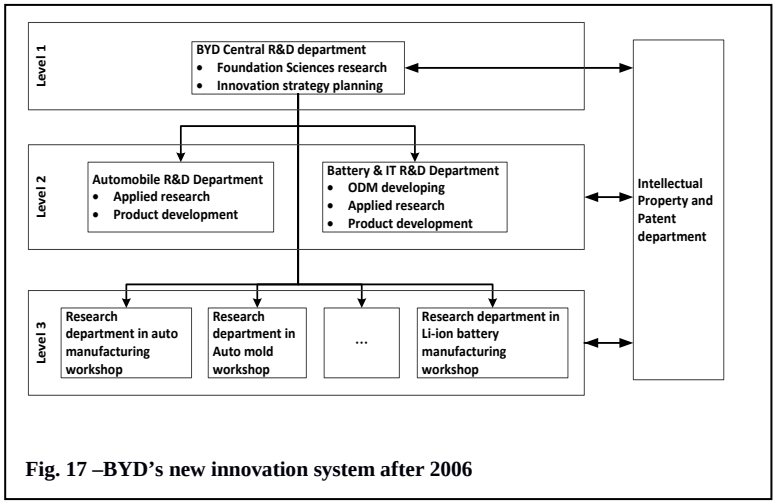


Fig. 17 –BYD's new innovation system after 2006

Along with the other innovation methodologies is BYD's IPR strategy as BYD is a technology based company. In 2003 it helped BYD to win the litigation by Sony in Japan. On 7th, August, 2003, without any pre-negotiation, Sony sued BYD with infringing one of its Li-ion battery patents – the No.2646657 patent in Tokyo District Court in Japan, Sony requested to forbid BYD exporting Li-ion battery to Japan. BYD's patent department cooperated with R&D departments and law affair department to reply to the charge that BYD didn't infringe Sony's No.2646657 patent at all. On 8th, October, 2003, after the court debate, Tokyo District Court pronounced the judgment that BYD didn't infringe Sony's patent. After won the litigation, the patent department made a report to the board that the Sony's No.2646657 patent should not be valid. In March of 2004, BYD applied to JPO (Japan Patent Office) to declare the No.2646657 patent invalid. In January of 2005, JPO declared the No.2646657 patent invalid. Sony appealed in the Intellectual Property High Court (A special branch of Tokyo High Court) to rescind the declaration of JPO. In November, 2005, the Intellectual Property High Court overruled the claim of SONY. In December, 2005, SONY revoked all the claims to BYD from Tokyo District Court.

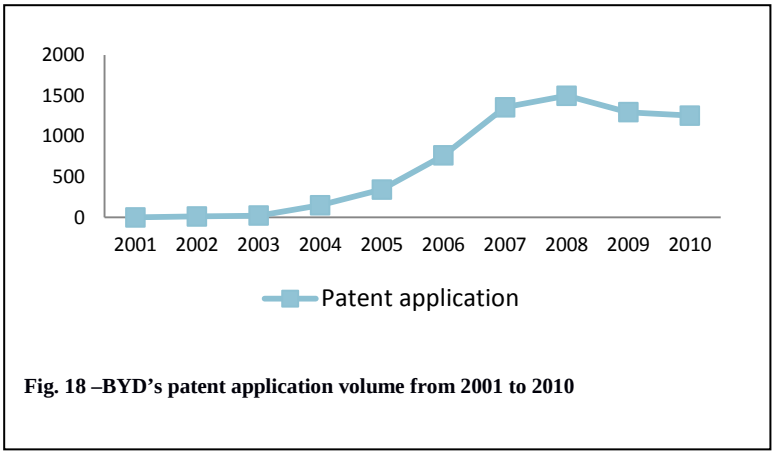


Fig. 18 –BYD's patent application volume from 2001 to 2010

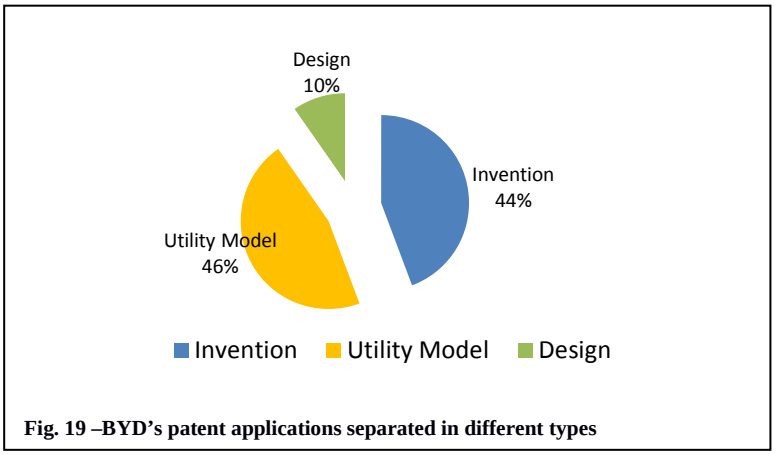


Fig. 19 –BYD's patent applications separated in different types

The period from 1995 to 2000 is the period for BYD to accumulate its technology power and to form its IPR strategy. The period is the process of BYD to recharge its accumulation of technology. From 2001 to 2006, BYD's IPR strategy started to be implemented that the volume of the yearly patent

application raised slowly but unfalteringly.

From 2006 to 2008, BYD's patent applications got a quick growth. The main reason is after entered the automobile industry, BYD paid the great attention on it along with BYD's high efficient R&D structure and its IPR management. The other reason is BYD's development of the new energy industry and NEV. As the new energy industry and NEV are regarded as the green technology of the future, BYD put a great power on it in order to occupy a leading position in the competition of the future.

The patent application volume can only describe that BYD is a patenting practitioner; it can't give the detailed information about the ingredients of BYD's patent applications. As the patent can be divided into three types - invention, utility model and design, the patenting behavior in different type may help us to address BYD's patenting strategy. Invention is regarded novel and inventive and has a protection period of 20 years. The number of the inventions can obviously indicate the innovative ability the enterprise has. As is showed in the following chart, the inventions takes forty-four percent of total patent applications which means BYD puts a great attention on its core technology development. The utility model takes forty-six percent of total patent applications almost the same percentage as the inventions. In comparison to invention, utility model is less inventive. The utility model is mainly concerned to the development of existing technology or process. The utility model normally can be directly used in the new product development. BYD also focuses on the products improvement and new product development. The design takes only ten percent of total patent applications. BYD's innovation strategy can be concluded as innovating for future, changing for today.

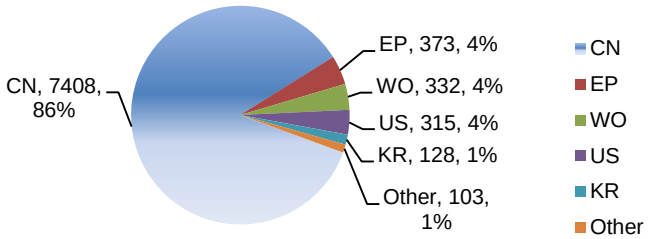


Fig. 20 –BYD's patent application filed in different countries and regions s

As China is BYD's main market, most of BYD's patent applications concentrated in China which takes eighty-six percent share of total applications. BYD also has developed an international patent strategy as now BYD's rechargeable battery business is running in many foreign countries, and also the automobile business in the future. As showed in the following chart, BYD's patent applications filed by WIPO are 332 pieces, filed by EPO are 373 pieces. USPTO has filed 315 pieces which is the most among the single country patent offices. Korea Patent Office has filed 128 pieces.

IPC Sub class	Volume	Percentage of total
H01M	1664	19.1%
H05K	344	4.0%
G06F	254	2.9%
B60K	232	2.7%
G02F	222	2.6%
G01R	202	2.3%
H04M	201	2.3%
H02J	195	2.2%
H01L	190	2.2%
B60R	137	1.6%

Table 7 –Top 10 IPC Subclasses of BYD's patent applications

It indicates that BYD's main markets abroad concentrates in USA and European countries as the cellphone markets in these countries are large. Korea, which is the big consumer electronics manufacturer, is also the big market for BYD.

If classified by IPC Subclass, BYD's patent applications can be classified by more than 700 IPC subclasses. The patent applications of the top ten IPC subclasses in total make approximately 42% share of all the applications of which the IPC subclass H01M takes the biggest share of 19.1%. H01M is defined as "Processes or means, e.g. batteries, for the direct conversion of chemical energy into electrical energy". It shows that BYD has a big patent portfolio in rechargeable battery sector which is an important factor of BYD's future developing in the NEV industry.

7: An empirical research on the joint-venture indigenous innovation

The so called "joint-venture indigenous innovation" means the joint-venture automobile enterprises of China create new brands and secondary-innovate based on the technology platform purchased or transferred from the foreign partners of the joint-ventures. The intellectual property rights (including the brands) of the secondary-innovation belong to the joint-ventures, the double sides of the joint-ventures share the IPRs. It is a new model of the innovation in China's automobile industry and different with the innovation model of the independent brands and the joint-ventures. Normally, the innovation model of the automobile joint-ventures is the foreign partners provide car types and related technologies except core technologies; the Chinese partners (most of them are the state-owned automobile enterprises) cooperate on the localization development in order the introduced car type to fit the needs of Chinese consumers well. But before the joint-venture indigenous innovation, all the products of the joint-ventures are sold under the brand of the foreign partners. Now all the profits of the new brands created by the joint-ventures belong to the joint-ventures.

The joint venture	Brand	Car Type	Time on market
SAIC-GM Wuling	Baojun	630	August,2011
GAC Honda	Everus	S1	April,2011
Dongfen-Nissan	Venucia	D50	April,2012
Dongfen-Honda	CIIMO	CIIMO	April,2013
Bejing Hyundai	Shouwang	SW1	2014
Dongfeng Yueda KIA	Dianyue	D1	Unknown
FAW-Volkswagen	Kaili	Unknown	Unknown
Shanghai Volkswagen	Tantus	E-lavida	Unknown
Chanan Mazda		C401	Unknown
Chanan Ford		New car type from Ford	Unknown
GAC Toyota		A new electrical car	Unknown
FAW-Toyota		Luxury Car	Unknown
Brilliance BMW		New Energy Vehicle	Nov,2013

Table 8 – Number of R&D employees, 2003-2008

The first step was taken by Guangzhou-Honda, in 2007 Guangzhou-Honda announced the new brand "Everus", the concept of the joint-venture indigenous brand was the first time shown to the public. In Feb, 2011 the first car type of "Everus" – S1 came off the product line. The S1 was based on the Honda's car type – Fit. In a short word, the Everus S1 was a Honda Fit but under the different brand. After Everus, the SAIC GM Wuling (joint-venture of SAIC, GM and Wuling) released the new

brand “BAOJUN” (meaning "treasured horse"), Dongfeng – Honda released the new brand “CIIMO”, etc.

The reason for the joint ventures to perform the indigenous innovation strategy

- To evade the limit of the indigenous innovation strategy in order to take part in the public procurement.

  The release of the indigenous brands by the automobile joint-ventures is the result of China’s indigenous innovation strategy. In 2009 “Plan on Adjusting and Revitalizing the Auto Industry” was announced by the State Council of China in which the indigenous innovation, cooperation with foreign enterprises, acquisition and merging domestic and abroad were supported to develop the indigenous brand. Especially, the indigenous brand was defined by the “Plan on Adjusting and Revitalizing the Auto Industry”.

  - The trademarks of the indigenous brands should be registered in China by the automobile enterprises in China (including the joint-ventures).
  - The trademarks should be owned exclusively by the automobile enterprises in China (including the joint-ventures) all over the world.
  - The automobile enterprises in China (including the joint-ventures) should own the intellectual property rights, the industrial property and the rights to transfer the technology.
  - The trademarks should be obviously marked on the vehicle products.

  The joint-venture indigenous brand could fulfil all the above rules. That is the direct reason for the automobile joint-ventures to develop indigenous brands.

- To avoid the limitation of the government to the joint-ventures.

  The huge market needs stimulates the foreign automobile enterprises to develop in China. But to satisfy the market needs, the joint-ventures have to build more factories in China, there are a lot of limitations from the government to the joint-ventures. From 2010, the Chinese government set a series of the thresholds to limit the expansion of the joint-ventures. To own the intellectual property rights and the plan of developing New Energy Vehicles became the important conditions for the joint-ventures to obtain the admission to build new factories. A lot of the joint-venture indigenous brands were set to fulfil the rules, so the first car types of those indigenous brands were New Energy Vehicles. The indigenous brand “Tantus” of Shanghai-Volkswagen, the indigenous brand “Shouwang” of Beijing-Hyundai were released under this condition.

- To compete with the indigenous brands of the Chinese automobile enterprises.

  Beside to fulfil the policies, another reason is to occupy the low price level market. Before 2006, the Chinese automobile market was a three level structure according to the price. The imported vehicle occupied the high level. The vehicle products of the joint-ventures occupied the middle level. The domestic brands (including the brands of the state-owned enterprises and the

independently owned enterprises) occupied the low level market. The products of the joint-ventures were sold under the trademark of the foreign brands, so these products had to keep the price strategy identical with the global market. But now with the creation of the new indigenous brand, the joint-ventures can compete with the Chinese domestic brands in the low-price level market.

The factors	The reason	Category
The automobile policies set the limittation	Fulfil he policy	The drive force of the innovation
The Chinese consumer needs the new brand and new car types	The demand of the market	
If not perform the indigenous innovation the joint venture always is only the factory while the foreign partner controls the technology	The blockade of the technology	
The joint-venture has the technology base to develop on	The technology condition	
The joint-venture can have double brands to compete on the market	The strategy of the brand	The strategy factor
To occupy the low price level market segment	The market segments	
The indigenous brand belongs to the joint-venture, the partners of double sides share the property according to their shareholdings of the joint-venture	Intellectual property rights	The indigenous innovation mode
The R&D is led by the research insititute of the joint-ventures.	The R&D teams	
The decision-making authority belongs to the joint-venture, not to either side of the partners of the joint-venture	The decision-making authority of the R&D	
Based on the existing car type of the joint-ventures sourced from the foreign partner	The product source	The technology support from the foreign partner of the joint venture
The core-compoments are supplied by the suppliers of the joint-ventures	The supply chain	
The foreign partner provide the technology data	Technology source	
The engineers of the foreign partner support the development	Technology support	
The engineers of the Chinese partner take part in the whole process of the development	Technology absorb	Technology transfer
The key part of the development is to train the R&D team of the joint venture	Training	
The joint venture set the R&D institute to perform R&D	Set R&D institutes	R&D investment

Table 9 –The factors for the joint-ventures to develop the indigenous brands

8: Conclusion

It has passed six years since the indigenous innovation strategy was announced in 2006. As is showed in the results, the implementation of the indigenous innovation strategy has different impact on the different type of the automobile enterprises in China. The state-owned automobile enterprises have the longest history, the largest scale and the strongest support from the Chinese government. But from the beginning the 1980s the huge technology and management gap in comparison with the foreign automobile enterprises made them to cooperate with the foreign companies in order to obtain the rapid development. In the process of cooperation with the foreign partners the

state-owned automobile enterprises gradually lost the self-innovation ability as the technology could be involved by the foreign partners. The situation was changed since the indigenous innovation strategy was announced. The state-owned started to develop self-innovation ability via different ways like IPR transfer, co-innovation with foreign companies and setting up oversea R&D centers, etc.

The indigenous innovation strategy has little direct impact on the innovation strategy of the foreign companies as the technology centers normally are in their home countries. As a part of the foreign companies, the joint-ventures didn't have the clear IPR strategy before the indigenous innovation strategy was announced as the joint-ventures originally was defined as the manufacturing bases of the foreign companies. But after 2006 under the pressure of the indigenous innovation strategy, the joint-ventures started to turn from the manufacturing base to the innovative manufacturing base which means the joint-ventures try to obtain the ability of innovation to get the better opportunity in the Chinese automobile market as they are more close to the Chinese market than their foreign owners.

Although the non-state-owned automobile enterprises entered in the automobile industry almost 20 years late than the state-owned companies and the automobile joint ventures, the non-state-owned companies stand on the giant's shoulder as the state-owned companies and their joint-ventures has already build up the whole supply chain of the automobile industry. The non-state-owned automobile enterprises normally have the clear innovation strategy and IPR strategy and they are also policy intensive. The indigenous innovation strategy gives the non-state-owned companies a strong stimulation in the technology innovation as they always active in innovation and the IPR protection.

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